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New records of one *Amygdalaria* and three *Porpidia* taxa (*Lecideaceae*) from China

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Abstract —Four lichen taxa of *Lecideaceae*, *Amygdalaria consentiens* var. *consentiens, Porpidia carlottiana, P. lowiana,* and *P. tuberculosa,* are reported for the first time from China.

Key words —Asia, *Lecideales,* lichens

Introduction

The family *Lecideaceae* Chevall. contains about 23 genera and 547 species, of which the largest genus is *Lecidea* Ach., containing about 427 species (Kirk et al. 2008, Fryday & Hertel 2014). In China, twenty-three species of the other genera in *Lecideaceae* have been reported, including two each of *Amygdalaria* Norman, *Bellemerea* Hafellner & Cl. Roux, and *Immersaria* Rambold & Pietschm.; one each of *Lecidoma* Gotth. Schneid. & Hertel, *Paraporpidia* Rambold & Pietschm., and *Stenhammarella* Hertel; and 16 species of *Porpidia* Körb. (Hertel 1977, Wei 1991; Aptroot & Seaward 1999; Aptroot 2002; Aptroot & Sparrius 2003; Obermayer 2004; Guo 2005; Zhang et al. 2010, 2012; Wang et al. 2012; Ismayi & Abbas 2013; Hu et al. 2014).

Amygdalaria and *Porpidia* are obviously very closely related. Both have large halonate ascospores, a high hymenium, *Porpidia*-type asci, and a dark pigmented hypothecium and are (with a few exceptions) restricted to lime-free, silicate rocks. However *Amygdalaria* can be best distinguished from *Porpidia* by the presence of cephalodia, the higher hymenium (over 130 μm), the larger ascospores (generally 20–35 × 10–16 μm) with conspicuous, rather compact epispores, and a tendency toward a brownish or yellowish pink thallus (Inoue 1984, Brodo & Hertel 1987, Gowan 1989, Smith et al. 2009).

During our research on the lecideoid taxa of *Lecideaceae* in China, we have identified four taxa new to the country: *Amygdalaria consentiens* var. *consentiens*, *Porpidia carlottiana*, *P. lowiana*, and *P. tuberculosa*.

Materials & methods

The studied specimens are preserved in the Lichen Section of Botanical Herbarium, Shandong Normal University, Jinan, China (SDNU); Herbarium Mycologicum Academiae Sinicae – Lichenes, Beijing, China (HMAS-L); and the Herbarium of the Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, China (KUN). The morphological and anatomical characters were examined under a stereomicroscope (COIC XTL7045B2) and a polarizing microscope (Olympus CX41). The thalli and medullae were tested for identification with K (10% aqueous KOH solution), C (saturated aqueous NaClO solution), I (a 10% aqueous KI solution), P (a saturated *p*-phenylenediamine solution in 95% ethyl alcohol). The lichen substances were identified using standardized thin layer chromatography techniques (TLC) with solvent system C (Orange et al. 2010). Photos of these lichens were taken under Olympus SZX16 and BX61 with DP72.

Taxonomic descriptions

Amygdalaria consentiens (Nyl.) Hertel, Brodo & Mas. Inoue, J. Hattori Bot. Lab. 56: 322 (1984) **var. *consentiens*** Fig. 1

Morphology — Thallus continuous, cracked-areolate, usually thick, light orange to brownish gray, often becoming oxidated orange; medulla I–; prothallus black, thin and conspicuous; cephalodia mostly flush with thallus surface, almost the same colour as the thallus, but occasionally pinker or gray, containing *Stigonema;* soredia absent. Apothecia entirely sunken in thallus, (0.35–)0.45–0.9 mm diam., usually one or two per areole; disc dark brown to black, margin slightly to moderately rusty orange pruinose. Exciple black-brown, 50–70 μm wide, without crystals; epihymenium brownish, with orange crystals; hymenium hyaline, 150–200 μm tall; subhymenium colorless, 45–60 μm tall; hypothecium blackish brown, usually thin, bowl-shaped; paraphyses strongly anastomosed and branched, almost moniliform at the apical part, with ±swollen apices. Asci clavate, *Porpidia*-type; ascospores hyaline, simple, ellipsoid, 28–32(–35) × 14–17(–19) μm, halonate. Pycnidia immersed, conidia bacilliform, 6–9 × c. 1 μm.

Chemistry — Thallus and medulla K–, C–, KC–, P–. No lichen substances were detected by TLC.

Distribution — *Amygdalaria consentiens* has been reported from Asia, Europe, and North America (Inoue 1984, Brodo & Hertel 1987, Smith et al. 2009). New to China.

Specimen examined: **CHINA**. **Yunnan**, Luquan, Mt. Jiaozixueshan, alt. 3800 m, on rock, 26 Oct. 2008, Z.J. Ren 20108488 (SDNU).

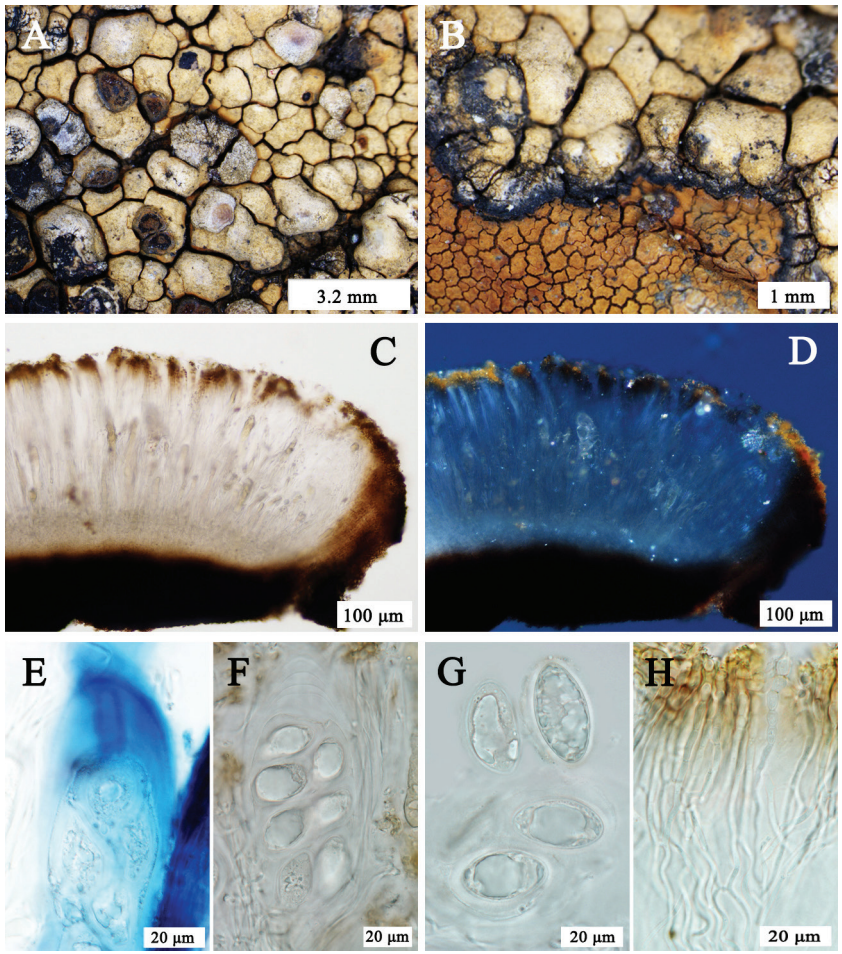

Fig. 1 *Amygdalaria consentiens* var. *consentiens* (Ren 20108488, SDNU). A: thallus; B: prothallus; C: apothecium section; D: epihymenium with crystals; E: amyloid reaction of ascus; F: ascus and ascospores; G: ascospores; H: paraphyses.

Comments —*Amygdalaria consentiens* var. *consentiens* is morphologically similar to *A. consentiens* var. *japonica* and *A. continua*, but *A. consentiens* var. *japonica* contains stictic and constictic acids, while *A. continua* has a smooth to finely rimose thallus which is rarely cracked-areolate.

Porpidia carlottiana Gowan, Bryologist 92: 39 (1989) Fig. 2

Morphology — Thallus crustose, finely cracked to subrimose, 0.15–0.25 mm thick, whitish gray; medulla I–; prothallus continuous between thallus

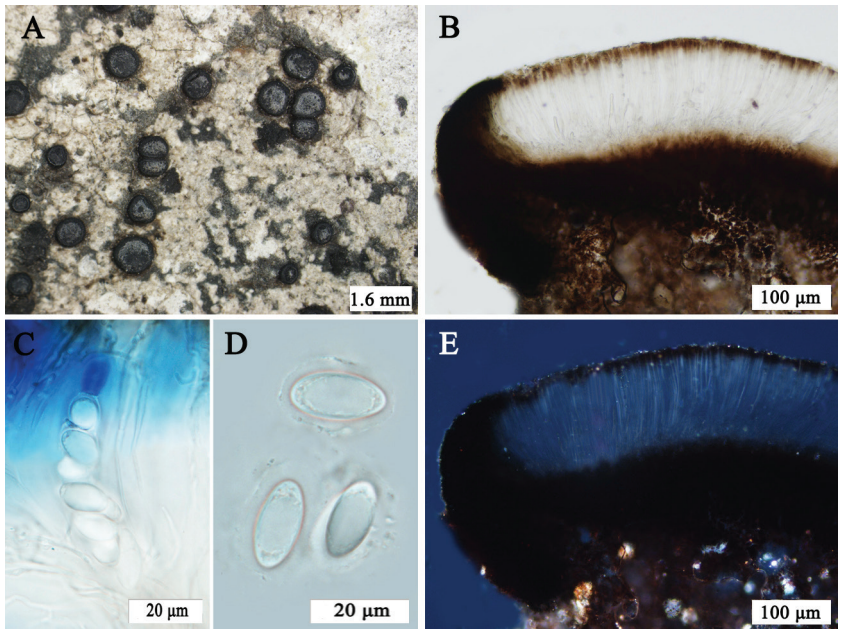

Fig. 2 *Porpidia carlottiana* (Wang 20127123, SDNU). A: thallus; B: apothecium section; C: amyloid reaction of ascus; D: ascospores; E: exciple and epihymenium without crystals.

patches, black, thin; soredia absent. Apothecia scattered or contiguous, sunken in thallus when young, becoming sessile on a broad base when mature, 0.5–1.1(–1.5) mm diam.; disc black, plane to weakly convex, usually with heavy whitish pruina; margin bare, distinct, regular to flexuose. Exciple dark brown to black at margin, brown within, 90–105 μm wide, without crystals; epihymenium yellowish brown or olive brown, without crystals; hymenium hyaline, 90–105(–130) μm tall; subhymenium 20–25 μm, hypothecium blackish brown; paraphyses strongly anastomosed and apically branched. Asci clavate, *Porpidia*-type; ascospores hyaline, simple, ellipsoid, 17–20 × 7–10 μm, halonate. Pycnidia not observed.

Chemistry — Thallus and medulla K–, C–, KC–, P–. 2'-O-methyl-superphyllinic acid was detected by TLC.

Distribution — *Porpidia carlottiana* has been reported from North America (Gowan 1989). New to China.

Specimen examined: **CHINA. Yunnan**, Lijiang, Mt. Laojunshan, alt. 3800 m, on rock, 5 Nov. 2009, H.Y. Wang 20127123 (SDNU).

Comments — *Porpidia carlottiana* is closely related to *P. rugosa*, which also produces pruinose apothecia and 2'-O-methylsuperphyllinic acid. However, *P. rugosa* always has soredia, and the apothecia rarely seen.

Porpidia lowiana Gowan, Bryologist 92: 49 (1989) Fig. 3

Morphology — Thallus crustose, continuous, finely cracked to rimose-areolate, 0.2–0.5 mm thick, yellowish gray to whitish, sometimes dark gray or greenish gray; medulla I–; prothallus absent; soredia absent. Apothecia scattered to contiguous, soon becoming broadly sessile, 0.5–1.3 mm diam.; disc black, non-pruinose to moderately pruinose; margin bare, distinct, even to weakly crenulate, regular to flexuose. Exciple mostly black and carbonaceous at exciple margin, hyaline within, 55–90 µm wide, with crystals that are soluble in K and C; epihymenium olive brown, without crystals; hymenium hyaline, 70–110 µm tall; subhymenium 18–26 µm, hypothecium blackish brown; paraphyses strongly anastomosed and apically branched. Asci clavate, *Porpidia*-type; ascospores hyaline, simple, ellipsoid or tear-drop-shape, 14–16(–25) × (4.5–)6–8 µm, halonate. Pycnidia not observed.

Chemistry — Thallus and medulla K–, C–, KC–, P–. Confluentic, 2'-O-methylmicrophyllinic, and 2'-O-methylperlatolic acids were detected by TLC.

Distribution — *Porpidia lowiana* has been reported from Europe and North America (Gowan 1989, Smith et al. 2009). New to China.

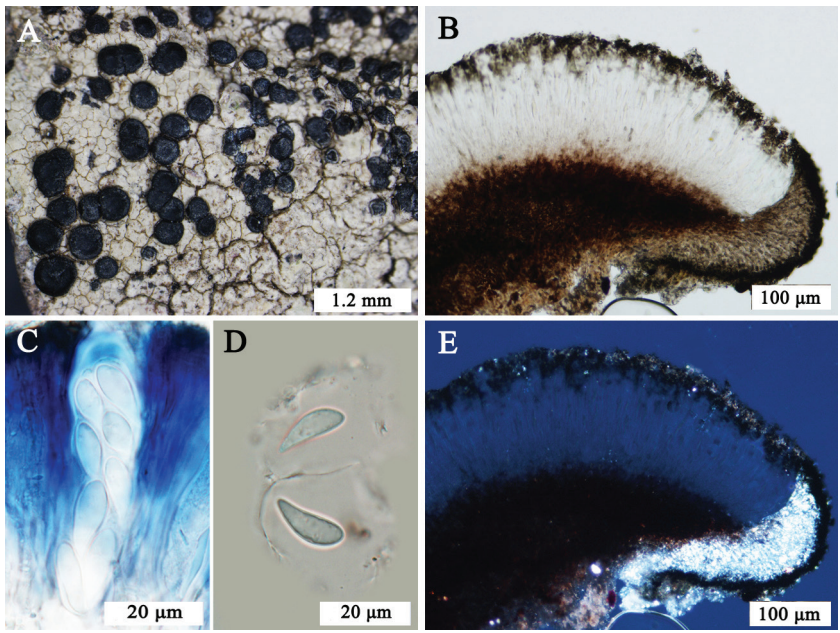

Fig. 3 *Porpidia lowiana* (Ren 20102097, SDNU). A: thallus; B: apothecium section; C: amyloid reaction of ascus; D: ascospores; E: exciple with crystals.

Specimens examined: **CHINA**. **Helongjiang**, Tahe, Mt. Mengkeshan, alt. 555 m, on rock, 14 Aug. 2009, Q. Ren 20102097 (SDNU). **Inner Mongolia**, Mangui, alt. 900 m, on rock, 13 Sep. 1977, J.C. Wei, 074581 (HMAS-L); **Sichuan**, Dukou, Mt. Dabaoding, alt. 1950 m, on rock, 21 Jun. 1983, L.S. Wang 83-184 (KUN); **Yunnan**, Xinping, Mt. Mopan, alt. 2000 m, on rock, 20 Dec. 2008, L.S. Wang 08-30003 (KUN); Chuxiong, Mt. Zixi, alt. 2060 m, on rock, 31 Aug. 2005, L.S. Wang 05-25263 (KUN); Lincang county, Matai village, alt. 1650 m, on rock, 20 Oct. 2003, L.S. Wang 03-22921, 03-22922 (KUN); Yimen, alt. 1600 m, on rock, 10 Dec. 1990, L.S. Wang 11707 (KUN).

Comments — *Porpidia lowiana* is closely related to *P. cinereoatra*, from which it differs mainly in having a thinner, yellower thallus, thicker proper margin (c. 0.05 mm in *P. cinereoatra*), and sessile apothecia (mainly sunken in *P. cinereoatra*).

Porpidia tuberculosa (Sm.) Hertel & Knoph, Beih. Nova Hedwigia 79: 438 (1984)

Fig. 4

Morphology — Thallus crustose, continuous, subrimose to distinctly rimose-areolate, 0.2–0.3(–0.5) mm thick, medium gray or sometimes rusty orange; medulla I+ violet; prothallus usually present when abutting another lichen, black; soralia present, 0.3–0.7 mm diam., round to irregular, scattered to crowded, shallowly erose or abraded, usually with slightly raised rim; soredia farinose to granular, white, pale gray or flecked blue-gray or blackish, I+ violet. Apothecia occasional, scattered, soon becoming sessile, 0.9–1.5 (–1.7) mm diam.; disc black, plane to subconvex, weakly to moderately pruinose; margin bare, distinct, regular to flexuose. Exciple greenish to brownish black at exciple margin, dark brown within, 90–140 μm wide, without crystals; epihymenium olive brown, without crystals; hymenium hyaline, 90–105 μm tall; subhymenium 35–50 μm, hypothecium blackish brown; paraphyses strongly anastomosed and apically branched. Asci clavate, *Porpidia*-type; ascospores hyaline, simple, ellipsoid, 17.5–22 × 7–8 μm, halonate. Pycnidia immersed, conidia bacilliform, 7.5–10 × c. 1 μm.

Chemistry — Thallus and medulla K–, C–, KC–, P–. Confluentic, 2'-O-methylmicrophyllinic, and 2'-O-methylperlatolic acids were detected by TLC.

Distribution — *Porpidia tuberculosa* has been reported from Asia, Macaronesia, Europe, and North & South America (Hertel 1984, Smith et al. 2009). New to China.

Specimens examined: **CHINA**. **Hubei**, Shennongjia, Mt. Dashennongjia, alt. 3000 m, on rock, 27 Jun. 1984, J.C. Wei, 067994, 068005, 074292 (HMAS-L). **Yunnan**, Luquan, Mt. Jiaozixueshan, alt. 3800 m, on rock, 27 Oct. 2008, H.Y. Wang 20081180, 20082302 (SDNU).

Comments — *Porpidia tuberculosa, P. rugosa* and *P. soredizodes* all have a thallus with soralia. However, *P. rugosa* has a more verrucose thallus,

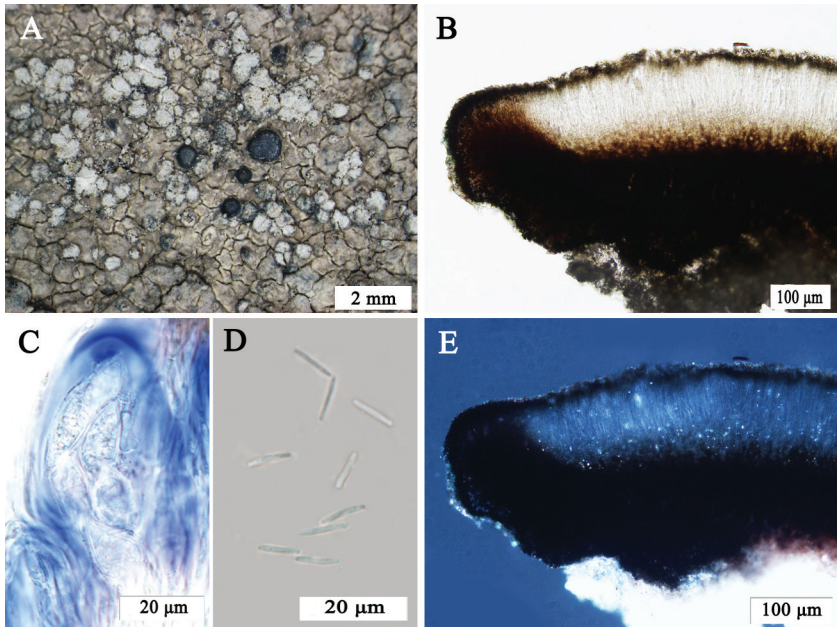

Fig. 4 *Porpidia tuberculosa* (Wei 067994, HMAS-L). A: thallus; B: apothecium section; C: amyloid reaction of ascus; D: conidia; E: exciple and epihymenium without crystals.

I– medulla, and contains 2'-O-methylsuperphyllinic and glaucophaeic acids. *Porpidia soredizodes* has an I– medulla as well as an overall smaller thinner (≤0.2 mm) darker thallus that contains stictic acid.

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